

Refer to: Burt TB, MacCarter DK, Gelman MI, et al: Clinical manifestations of synovial cysts. West J Med 133:99-104, Aug 1980

Clinical Manifestations of Synovial Cysts

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Although synovial cysts are most commonly associated with rheumatoid arthritis and osteoarthritis, they may occur in many other conditions. The clinical manifestations of these cysts are numerous and may result from pressure, dissection or acute rupture. Vascular phenomena occur when popliteal cysts compress vessels, and result in venous stasis with subsequent lower extremity edema or thrombophlebitis. Rarely, popliteal cysts may cause arterial compromise with intermittent claudication. Neurological sequelae include pain, paresthesia, sensory loss, and muscle weakness or atrophy. When synovial cysts occur as mass lesions they may mimic popliteal aneurysms or hematomas, adenopathy, tumors or even inguinal hernias. Cutaneous joint fistulas, septic arthritis or osteomyelitis, and spinal cord and bladder compression are examples of other infrequent complications. Awareness of the heterogeneous manifestations of synovial cysts may enable clinicians to avoid unnecessary diagnostic studies and delay in appropriate management. Arthrography remains the definitive diagnostic procedure of choice, although ultrasound testing may be useful.

SYNOVIAL CYSTS are fluid-filled spaces lined by synovial membrane and arise from diarthrodial joints, bursae and tendon sheaths. The first published report of a synovial cyst was made by Adams, an Irish surgeon, in 1840.¹ He described a cyst that extended from the knee joint into the popliteal space. An English surgeon, William Baker, reported his observations on synovial cysts

in 1877, resulting in the common eponym Baker cysts, for popliteal cysts.² Subsequently, synovial cysts have been described in numerous locations although the knees, shoulders and wrists remain the most frequently involved areas.

The common manifestations of synovial cysts, particularly those associated with rheumatoid arthritis, are well known. However, vascular and neurological sequelae as well as unusual causes and sites of involvement, have received less emphasis. Our recent experience involving patients with synovial cysts has suggested greater variety in presentation than is generally appreciated. This has led to our report of three cases and a review

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Submitted, revised, December 26, 1979

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of the common as well as the unusual features. Awareness by physicians of the various manifestations of synovial cysts is essential for accurate, expeditious diagnosis and proper management.

Reports of Cases

CASE 1. A 34-year-old woman with long-standing seropositive rheumatoid arthritis had asymptomatic swelling at the left elbow. An examination of the joint showed a large medial swelling in the region of the antecubital fossa that was not tender to palpation. Passive and active range of motion of the elbow was limited from 15 to 90 degrees. An arthrogram showed a large synovial cyst which communicated with the elbow joint (Figure 1). The cyst was treated with joint aspiration and intra-articular corticosteroid injection, resulting in a pronounced decrease in the swelling and disappearance of the apparent flexion contracture.

This case illustrates the occurrence of a large synovial cyst in an unusual location, which may impede the full movement of a joint and simulate a flexion deformity.

CASE 2. A 64-year-old man with seropositive rheumatoid arthritis of 20 years duration had severe pain and paresthesia of the right arm. An examination of the area showed considerable swelling of the right shoulder with cystic distention anteriorly and laterally. Mild erythema and warmth suggested possible joint infection. By aspirating the glenohumeral joint we collected 45 ml of cloudy, yellowish fluid. Gram stain and cultures of the fluid were negative. An arthrogram of the shoulder showed a cyst communicating with the glenohumeral and acromioclavicular joints (Figure 2). Aspiration of the joint and subsequent cyst resection with synovectomy provided only temporary relief of symptoms, with eventual recurrence of the cyst.

This case presents an instance of a synovial cyst of the subacromial bursa that developed following a rotator cuff tear secondary to the rheumatoid process.

CASE 3. A 74-year-old woman with seropositive rheumatoid arthritis of five years duration had severe pain in the left wrist associated with numbness and paresthesia of the thumb, index and middle fingers. The pain radiated to the left elbow and was unresponsive to orally given analgesics. An examination of the joint showed considerable tenderness of the left wrist, with swelling predominantly of the volar aspect. Tinel and Phalen

maneuvers were positive and a diagnosis of carpal tunnel syndrome was made. An arthrogram showed severe rheumatoid changes with narrowing of the intercarpal joint space and cartilage destruction. No communication with the area of the cystic swelling was detected. The cyst was then punctured and injected with contrast media. No movement of the fluid from the cyst to the wrist

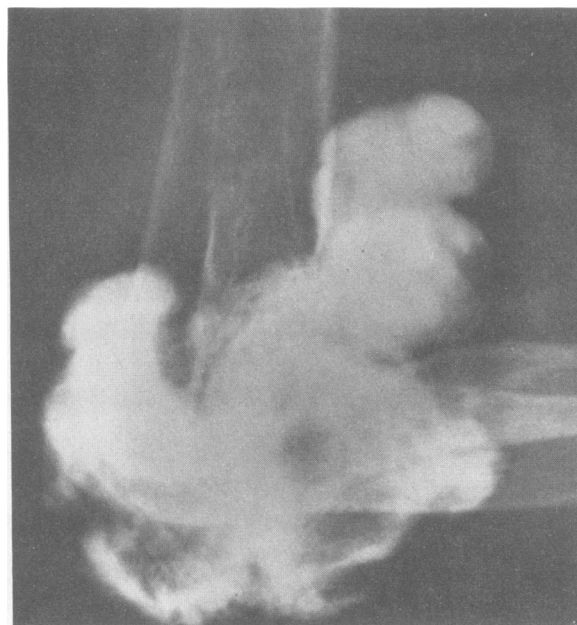


Figure 1.—Arthrogram showing a synovial cyst of the elbow communicating with the elbow joint.

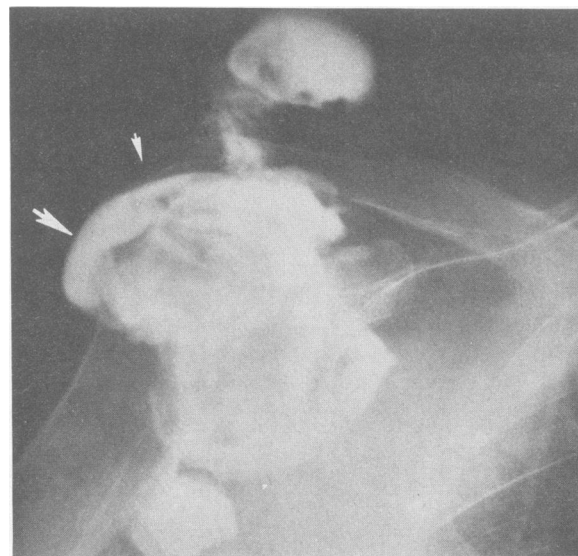


Figure 2.—Arthrogram showing a synovial cyst of the shoulder communicating with the glenohumeral and acromioclavicular joints. There is filling of the subacromial bursa (arrows), indicating an associated rotator cuff tear.

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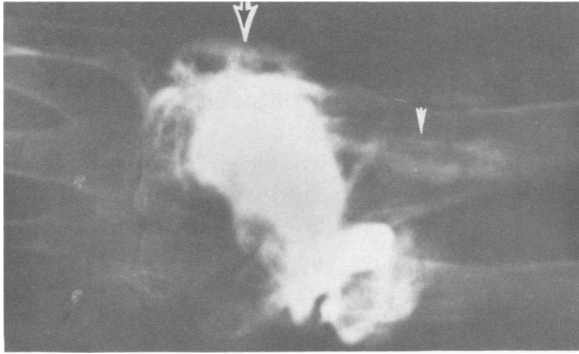


Figure 3.—Initially, arthrogram of the wrist showed no communication with cyst (dense contrast media overlying carpal bones). Cyst (larger arrow) then injected separately shows communication with flexor tendon sheath (small arrow).

joint was noted; movement of the fluid was continuous with the flexor tendon sheath (Figure 3). Treatment consisted of cyst aspiration, transverse carpal ligament resection and synovectomy. Carpal tunnel symptoms resolved postoperatively, but recurrence of the cyst was noted within five months.

This case illustrates median nerve entrapment caused by a synovial cyst of a volar flexor tendon sheath.

Discussion

Numerous pathological conditions may cause inflammation of the synovial membrane which, in turn, leads to increased production of synovial fluid in different parts of the musculoskeletal system, and may result in the formation of synovial cysts. A plethora of terms and eponyms have been coined to describe both synovial and non-synovial cysts. Unfortunately, because of a general lack of familiarity with these terms, this has led to more confusion than clarity. A brief review of terminology is therefore warranted.

Synovial fluid, which can be considered a form of liquid ground substance, is also known as synovia.³ The term synovia (Latin: syn-, with + ovum, egg) is first found in the writings of Paracelsus (1493-1541). He credited the origin of the word to early wound surgeons who compared the consistency of the gelatinous joint fluid with that of egg white.⁴ Synovia has a complex structure composed mostly of mucopolysaccharides (hyaluronic acids), proteins and occasional cells consisting of monocytes, lymphocytes and macrophages.^{3(pp13-14)} Synovial fluid is produced and absorbed by the

synovial membrane, which is derived from embryonic mesenchyme, and lines the nonarticulating parts of diarthrodial joints, synovial bursae and synovial tendon sheaths.⁵ This unique structure allows for movement between contiguous tissues with a remarkable lack of friction and for nutrition of the avascular articular cartilage of joints.

In pathological conditions, fluid can distend a bursa or tendon sheath, resulting in formation of a cyst. A synovial joint cyst results from herniation of the synovial membrane through the joint capsule or enlargement of a bursa communicating with the joint. Other cysts that lack a true synovial membrane and are lined by reactive fibrous tissue or by preexisting anatomical structures (such as tendons, muscles and bone), should be referred to as pseudocysts. Geodes are juxta-articular bone cysts that lack a true epithelial lining and are a form of pseudocyst.⁶ A ganglion is a cystic swelling adjacent to a tendon sheath or joint capsule which contains mucoïd fluid, but which is only infrequently lined by a synovial membrane.⁷ Therefore, most ganglia are pseudocysts.

Etiology

Any inflammatory, degenerative or traumatic condition that produces an effusion may contribute to the development of a synovial joint cyst. These cysts are most commonly associated with osteoarthritis or rheumatoid arthritis. In one study involving patients who had had rheumatoid arthritis affecting the knees for more than five years, the frequency of popliteal cysts approached 30 percent.⁸ In adults, synovial joint cysts have also been described in association with tuberculosis, osteochondromatosis, gout, pseudogout, giant cell tumor, brucellosis, Sjögren* syndrome, Reiter disease, systemic lupus erythematosus, psoriatic arthritis, pigmented villonodular synovitis, meniscal tears, neuropathic arthritis and juvenile rheumatoid arthritis.^{6,9-12} In children popliteal cysts occur primarily as the result of trauma.¹²

Synovial bursa and tendon sheath distention, with subsequent cyst formation, are associated with trauma or excessive exercise, rheumatoid arthritis, gout or pyogenic infections, although the cause in many instances is unknown. Bursitis and tenosynovitis with cyst formation may also

*The WESTERN JOURNAL's style regarding eponyms is that they are not written in the possessive form; therefore, Graves disease, Ewing sarcoma and Paget disease. An explanation may be found on page 78 of the July 1978 issue.

occur with other infectious, systemic and rheumatic diseases.^{3(p88)}

Location

Synovial joint cysts occur most frequently in the popliteal space and are called Baker cysts. However, they are often observed in the shoulders, wrists, fingers and feet as well.⁶ Uncommon locations include the elbows, ankles, hips and apophyseal joints of the spine.^{13,14}

Cysts of the tendon sheaths are often seen in the wrists and fingers. Distended and painful bursae over the ischial tuberosity (weaver's bottom), olecranon (miners' elbow), or prepatellar region (housemaid's knee) are not unusual.^{6,15}

Pathophysiology

A true synovial joint cyst results from herniation of the synovial membrane through the joint capsule or from enlargement of a bursa already communicating with the joint. In one series describing popliteal cysts, 56 percent were of bursal origin (semimembranosus and gastrocnemius), 31 percent from herniation and 13 percent were of indeterminate origin.⁹ Formation of synovial joint cysts by herniation occurs when a pathological process produces an effusion of fluid at the joint, with subsequent increase in intra-articular pressure. This increased pressure leads to extrusion of the synovial membrane through a segment of the joint capsule (often weakened by the same pathological process), with resultant cyst formation. Genovese⁸ has suggested that this represents a protective mechanism for decompression of a diseased joint.

A valvular mechanism allowing only unidirectional flow of synovial fluid from the joint into the cyst has been suggested by Jayson and Dixon.¹⁶ They summarized two possibilities which could result in this sort of valve: a ball-valve mechanism resulting from inspissated fibrin and cell debris within the cyst or a Bunsen valve resulting from the enlarging cyst compressing its own channel of communication.

Vascular Manifestations

Synovial cysts that cause vascular complications are observed most frequently in the popliteal region where they may cause popliteal vessel compression. Direct pressure on venous and lymphatic channels can result in stasis with edema of the leg. Swett¹⁷ reported that in several patients with edema of the leg, venography clearly illustrated

both stretching and compression of popliteal veins by Baker cysts. This circumstance might also be expected to increase the risk of deep venous thrombosis as a result of stasis.

Pseudothrombophlebitis is now a well-recognized entity caused by dissection or rupture of popliteal cysts, with subsequent clinical findings mimicking deep venous thrombosis.¹⁸ Generally, these patients have sudden pain and swelling of the calf, and may notice rapid reduction in the size of the cyst. On physical examination, warmth, erythema, swelling and even a positive Homan sign are frequently noted.¹⁸ On occasion these patients are treated with heparin because of a misdiagnosis of acute deep venous thrombosis. Unfortunately, these patients may be placed in needless jeopardy with the correct diagnosis remaining unrecognized while inappropriate anticoagulant therapy is initiated.

Rarely, acute rupture of a popliteal cyst and deep venous thrombosis may occur simultaneously.¹⁹ Although this is unusual, it emphasizes that both arthrography and venography should be carried out in cases in which coexistence of both processes is suspected or in which history and physical examination are consistent with either process.

Finally, synovial cysts may masquerade as aneurysms or hematomas. This may occur when a cyst lies adjacent to an artery, particularly in the femoral and popliteal regions. Arterial pulsations may be transmitted through the cyst, which may cause it to be confused with an aneurysm. Generally, a careful physical examination will easily differentiate a cyst from a vascular lesion, although arthrography or ultrasound testing may be necessary in some cases.

Neurological Manifestations

Neurological manifestations may result from nerve compression by synovial cysts. These may occur at any point where a peripheral nerve is trapped between an enlarging cyst and an inelastic structure (such as bone or fibrous structures). Entrapment neuropathies are common complications in patients with long-standing rheumatoid arthritis, and are characterized by pain, paresthesia, sensory loss, weakness or muscle wasting. Nakano²⁰ has estimated that approximately 45 percent of patients with chronic rheumatoid arthritis, severe peripheral joint involvement or subcutaneous nodules have one or more entrapment neuropathies during the course of their ill-

ness. Nerve compression by synovial cysts, however, is only one of several possible causes of entrapment in rheumatoid patients. Other mechanisms of compression may include tissue inflammation with edema and direct pressure secondary to bony malalignment from destruction of the rheumatoid joint. In addition, clinicians must be fully aware that noncompressive neuropathies secondary to vasculitis, nutritional deficiency and demyelination may be encountered in rheumatoid patients.

The carpal tunnel syndrome as discussed in case 3 is the most frequently encountered entrapment neuropathy of rheumatoid arthritis. Because the transverse carpal ligament is a relatively inflexible structure, volar tenosynovitis in this area often produces pressure on the median nerve. In approximately 25 percent of patients with rheumatoid arthritis the carpal tunnel syndrome develops; however, the proportion of cases resulting from entrapment by a synovial cyst is not known.²¹

Common peroneal nerve compression by a popliteal cyst may result in paresis of the peroneal and tibialis anterior muscles and extensor muscles of the digits. Sensory loss may also be present on the side of the leg and dorsum of the foot. Infrequently, rheumatoid synovial cysts result in entrapment or compression of the ulnar, radial or posterior tibial nerves.²⁰

An unusual neurological complication consisting of extradural compression of the spinal cord by a synovial cyst arising from a lumbar apophyseal joint was described by Linqvist.¹⁴ Cord compression resulted in radicular pain involving the anterior thigh and buttocks. Following laminectomy and cyst resection the patient recovered uneventfully. Interestingly, no reports of neurological sequelae from nonrheumatoid synovial cysts were found in the literature, although the potential for nerve compression is still present in such cases.

Miscellaneous Manifestations

In patients with rheumatoid arthritis, synovial cysts may occasionally erode through adjacent tissues and rupture through the skin, forming a cutaneous joint fistula. This type of fistula may arise either spontaneously or secondarily to a septic joint. Shapiro²² reported cutaneous joint fistulas involving the metatarsal-phalangeal, hip and knee joints in rheumatoid patients. Although on physical examination several of these mimicked a septic process, Gram stain and culture of the

synovial fluid were negative. These fistulas arise spontaneously and are therefore assumed to result from the rheumatoid inflammatory process. Cutaneous joint fistulas have also been reported arising spontaneously from noninfected popliteal cysts following a knee operation.²³ Septic arthritis, however, is a well-recognized complication in patients with rheumatoid arthritis and may occasionally result in formation of a fistula. In these patients cultures of the sinus and synovial fluids grow the same organism.

A synovial cyst may also appear as a mass adjacent to a joint and mimic a tumor, adenopathy or hematoma. Samuelson and Ward¹³ reported a rheumatoid synovial cyst of the hip presenting as an apparent inguinal hernia. Compression of the bladder by a hip synovial cyst with symptoms of dysuria, frequency, nocturia and dribbling was described by Watson.²⁴ Large cysts arising in the shoulder may mimic adenopathy or tumor by dissection into the axilla. Swelling of synovial cysts may also limit the full range of motion of a joint as occurred in patient 1. Rupture of the rotator cuff of the shoulder may precede or be associated with the formation of a subacromial synovial cyst as illustrated in the case of patient 2.

Radiology

The radiographic diagnosis of synovial cysts has been reviewed by various authors.^{25,26} Ultrasound testing, radionuclide scanning and computerized tomography (CT) have not been shown to provide definite advantages over arthrography. Radioactive isotope scans have been shown to be accurate in diagnosing popliteal cyst rupture; however, joint puncture and infusion of the isotope are still required. Also, these scans are of little help in showing other joint abnormalities such as meniscal tears, that may lead to synovial cysts. Ultrasound testing is an excellent method for detecting synovial cysts, but frequently is incapable of showing cysts that have already ruptured.²⁷ Cooper²⁸ recently reported a limited study which showed that computerized tomography could not delineate popliteal cysts that had not already been injected with contrast media. Furthermore, the appearance of the cyst on a CT scan after injection of air or contrast media adds little to the information obtained by conventional arthrography. At present, arthrography remains the definitive procedure for evaluation of synovial cysts, except when puncture of the cyst or joint is contraindicated or technically difficult, as in

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children. In these instances, ultrasound tests may have value.

Treatment

Most synovial cysts do not require specific treatment because they are asymptomatic and often resolve spontaneously or with treatment of the underlying disease process. Appropriate treatment of symptomatic synovial cysts generally includes rest, heat and aspiration of the fluid in the joint. Direct aspiration or injection of a true synovial cyst of the knee or elbow is usually best avoided because damage may result to important neurovascular structures, although arthrocentesis of the adjacent joint is often helpful.

In cases of ruptured popliteal cysts, elevation of the leg may also give relief. Application of ice-packs may be beneficial in cases of acute dissection of synovial cysts, regardless of the location. Intra-articular injection of steroids is often helpful and may relieve pain rapidly, but must be used cautiously. Surgical synovectomy is sometimes followed by recurrence of the cyst. However, anterior synovectomy of the knee alone, maintaining the protective function of the connecting bursa, has been shown to be successful.

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